
ISOPODS COLLECTED AT THE HAWAIIAN ISLANDS BY THE
U. S. FISH COMMISSION STEAMER ALBATROSS.

By HARRIET RICHARDSON, Ph. D.

ISOPODS COLLECTED AT THE HAWAIIAN ISLANDS BY THE U. S. FISH COMMISSION STEAMER ALBATROSS.

BY HARRIET RICHARDSON, PH. D.

The United States Fish Commission is undertaking a systematic exploration of the marine fauna of the Hawaiian Islands, under the direction of Dr. D. S. Jordan. During the summer of 1902, under the immediate charge of Prof. C. H. Gilbert, the *Albatross* was engaged in dredging in the vicinity, while a party of assistants explored the shore and shallow water.

The isopods collected were not numerous. Most of them are new to science, only two species in the collection, *Ligia hawaiiensis* Dana and *Cymothoa recta* Dana, having been previously recorded from the islands.

Two new genera of parasitic isopods, representing different families of *Epicaridea*, the *Dajidæ* and the *Bopyridæ*, are herein described. The Bopyrid genus is particularly interesting, because it is the first of that family known to occur in the visceral cavity of Decapods, the *Entomiscidæ* alone being known to have that position in relation to their hosts, the Brachyurous Crustacea.

CHELIFERA or TANAIOIDEA.

Family APSEUDIDÆ.

Apseudes sp. P

One mutilated specimen was obtained by the United States Fish Commission steamer *Albatross* off the south coast of Molokai Island, the Hawaiian Islands.

FLABELLIFERA or CYMOTHOIDEA.

Family ÆGIDÆ.

Æga quadratasinus Richardson sp. nov. Fig. 1.

Body (fig. 1 *a*) ovate, about $2\frac{1}{2}$ times longer than broad. Color uniformly light yellow.

Head with frontal margin rounded and produced in a small median process between the basal joints of the first pair of antennæ; posterior margin nearly straight. Eyes situated on the anterolateral margin, extending along each side from the posterior margin of the head to the proximal end of the third peduncular joint of the first pair of antennæ and separated from each other on the anterior margin by a distance equal to the length of one eye. The first pair of antennæ (fig. 1 *b*) have the peduncle composed of 2 short joints of equal length and a long, slender joint equal to the length of the first two taken together; none of these joints are dilated; the flagellum is composed of 24 joints and extends to the posterior margin of the second thoracic segment. The second pair of antennæ have a 5-jointed peduncle, the distal end of the fifth joint of which extends to the middle of the first thoracic segment; the flagellum is composed of 24 joints and reaches the posterior margin of the third thoracic segment. The frontal lamina or interantennal plate is cone-shaped, round and flat at its distal end, and produced at its proximal end to an acute point.

The segments of the thorax are equal in length. The epimera of the second, third, and fourth segments are not produced posteriorly beyond the margin of the segment; those of the fifth, sixth, and seventh segments are produced backward.

There is an arcuate carina on all the epimera which extends from the post-lateral external angle to the internal antero-lateral angle of the opposite side.

All 6 segments of abdomen distinct, the first segment a little shorter than the 4 following. The sixth or terminal segment is well rounded posteriorly, with a pronounced and wide emargination, quadrangular in shape, in the median line. On either side of this emargination the posterior margin is crenulate for some distance and provided with minute spines, about 8 on either side.

The uropoda (fig. 1 *c*) are about equal in length and are not longer than the terminal abdominal segment. The outer branch is oval in shape, denticulate, and provided with spines on the external and posterior margin. The inner branch is unlike the outer branch in shape, and tapers to a narrow extremity at the post-lateral side of the external margin, the external margin being almost straight; this branch is more distinctly crenulate on the lower part of the external margin and provided with small spines.

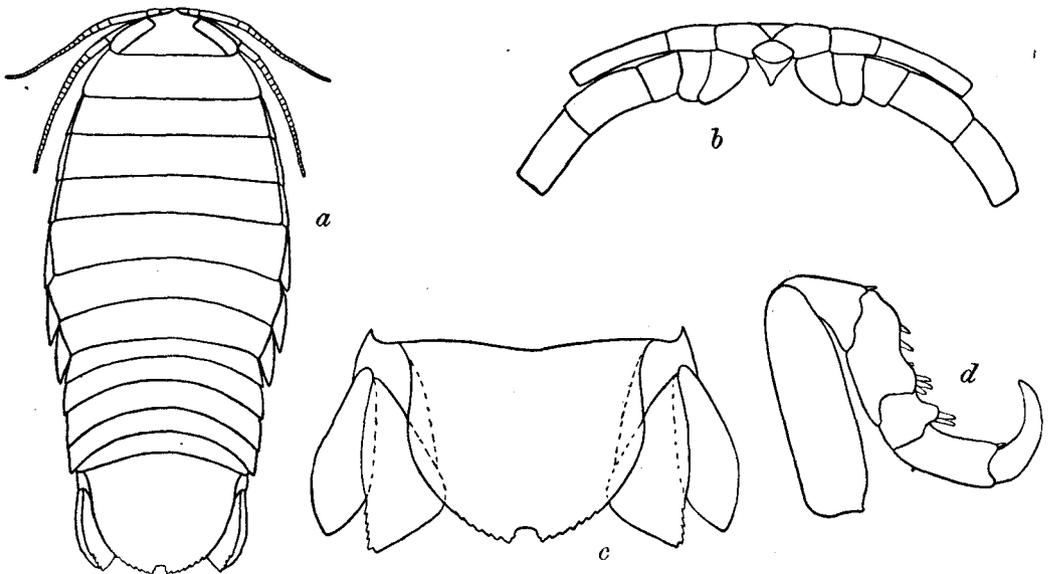


FIG. 1.—*Ega quadratasinus*. (a) General figure, $\times 4$; (b) Frontal lamina and peduncles of both pairs of antennæ, $\times 7$; (c) Terminal segment and uropoda, $\times 8$; (d) Leg of 3d pair, $\times 8$.

The first three pairs of legs are prehensile. On the third pair (fig. 1 *d*) there is 1 spine on the ischium, 6 on the merus, 2 on the carpus, and 1 at the distal end of the propodus. The 4 following pairs of legs are gressorial, and are provided with spines on the ischium, merus, carpus, and propodus.

Only one specimen was obtained in 1902 from Kauai Island, the Hawaiian Islands, by the United States Fish Commission steamer *Albatross*.

Type in United States National Museum. Cat. No. 28971.

This species approximates more closely to *Ega incisa*^a Schiedte & Meinert than to any other described species of the genus. It differs, however, in the shape of the abdomen, which is more triangular in *A. incisa*; in the shape of the terminal notch, which is V-shaped in *A. incisa*, more quadrangular in *A. quadratasinus*; in the smaller eyes, which do not meet in the median line as in *A. incisa* but are separated by a space equal to the length of one eye; by the longer antennæ of both pairs, each containing also a greater number of joints in the flagellum; and in having the prehensile legs provided with numerous spines, while in *A. incisa* there is a single spine on the ischium and a single one on the carpus.

^aNaturhistorisk Tidsskrift (3), xii, 1879-1880, pp. 373-374, pl. x, figs. 13-15.

Æga deshayesiana Milne Edwards.

Rocinela deshayesiana Milne Edwards, Hist. Nat. Crust., III, p. 243.

Æga deshayesiana Schiödte & Meinert, Naturhistorisk Tidsskrift, XII (3), 1879-1880, pp. 360-361, pl. VIII, figs. 7-9.

Locality.—Pailolo Channel, between Molokai and Maui Islands and Northeast Approach.

This species is recorded from the Mediterranean (Milne Edwards); from the Adriatic, at Fayal, the Azores, and Panorma (Schiödte & Meinert); from lat. 15° 40' N., long. 23° 5' 8" W. (Studer).

A single specimen was obtained by the *Albatross* which differs from those recorded as described and figured by Schiödte & Meinert only in having 7 spines instead of 6 on the merus, and in not having the single spine on the distal end of the propodus. Its occurrence in this locality is rather remarkable.

Rocinela hawaiiensis Richardson, sp. nov. Fig. 2.

Body (fig. 2 a) narrow, elongate, 2½ times longer than wide. Color uniformly yellow, with no markings.

Head triangular; front produced over the basal joints of the first pair of antennæ. Eyes very large and round, separated from each other by a distance equal only to half the width of one eye. First pair of antennæ, with a flagellum of 5 joints, extend to the end of the peduncle of the second pair of antennæ. Second pair of antennæ, with a flagellum of 17 joints, reach the posterior margin of the second thoracic segment.

First two segments of thorax subequal in length; third and fourth subequal and a little longer than the first two; fifth and sixth longest, each one nearly equal to the first two segments taken together; seventh segment shorter than the two preceding, about equal to the third or fourth. Epimera of the last four segments acutely pointed at their posterior extremities; those of the second and third segments more rounded posteriorly.

The first abdominal segment is entirely concealed by the seventh thoracic segment except at the sides; the three following segments are subequal, with acutely produced postero-lateral angles; the fourth segment has the sides not produced and mostly covered by the postero-lateral angles of the preceding segment; terminal segment narrowly rounded. Uropoda oar-like, subequal in length and equal in width. Both branches are faintly crenulate on the external margin. The basal joint of the uropoda extends only half the length of the inner branch.

First 3 pairs of legs (fig. 2 b) prehensile, with long, slender, curved dactyli; propodus armed with 3 spines; the carpus with 1 spine, and the merus with 3 spines, except on the first pair of legs. The 4 gressorial legs are long and slender and armed with few spines.

Only one specimen was taken by the U. S. Fish Commission steamer *Albatross* at Kauai Island, the Hawaiian Islands, at a depth of 636 to 414 fathoms.

Type in U. S. National Museum. Cat. No. 28972.

This species is perhaps nearer to *R. orientalis* Schiödte & Meinert^a than to any other known species of the genus. It differs from that form, however, in the much larger eyes which are separated.

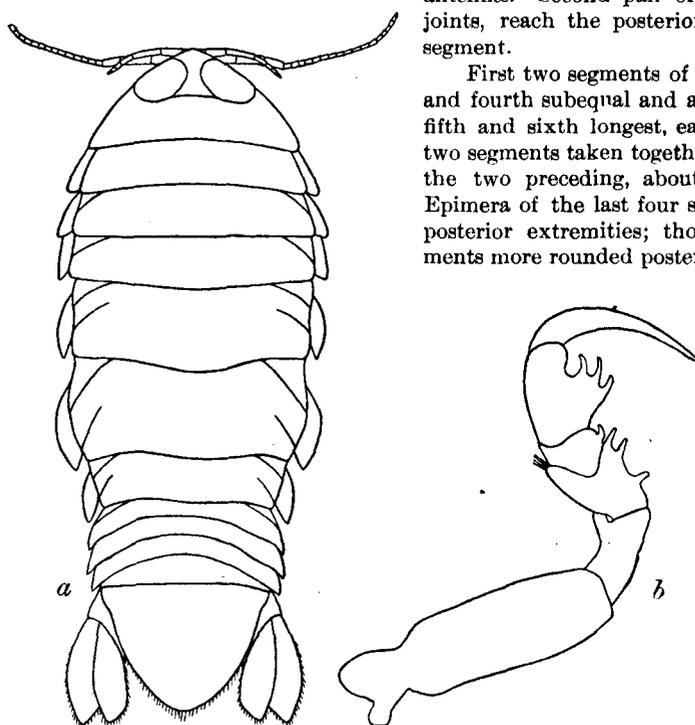


FIG. 2.—*Rocinela hawaiiensis*. (a) General figure, ×4; (b) Leg of second pair, ×8

^aNaturhistorisk Tidsskrift, (3), XII, 1879-80.

by a distance equal only to half the width of one eye, while in *R. orientalis* the eyes are separated by a distance equal to one-third the width of the head; in the narrower and more elongate body; in having the two branches of the uropoda of equal length and width, while in *R. orientalis* the outer branch is narrower and shorter than the inner branch; in the shorter basal joint of the uropoda, it being equal to half the length of the inner branch, while in *R. orientalis* the basal joint extends almost to the posterior extremity of the inner branch; and in the narrower terminal abdominal segment.

Family CYMOTHOIDÆ.

Cymothoa recta Dana.

Cymothoa recta Dana, U. S. Expl. Exp. Crustacea, XIV, pp. 751-752, pl. XLIX, fig. 13 a-c.

Locality: Puako Bay, Hawaii.

Dana's specimens were obtained at Hilo, Hawaii, by Dr. C. Pickering.

Only one adult specimen was obtained, but a large number of young males (fig. 3), which are probably the young of this species, were taken from the following localities: Between Kauai Island and Modu Maru or Bird Island; north coast of Molokai Island; south coast of Oahu Island. Depth, 6½ to 299 fathoms. These young specimens are probably at a stage somewhat later than the young of the first and second stages described by Schiøedte & Meinert^a for *C. astrum* Linn. and *C. eximia*, because all seven pairs of legs are present. The pleopods, uropods, and terminal segment are, however, fringed with hairs, and the first and second antennæ are very long, the first pair reaching the extremity of the first thoracic segment and composed each of ten joints, the second pair extending to the posterior margin of the third thoracic segment and composed each of 16 long joints. The eyes are large and post-laterally situated, and the frontal margin of the head is well rounded. The antero-lateral angles of the first thoracic segment are not produced along the sides of the head as in the adult.

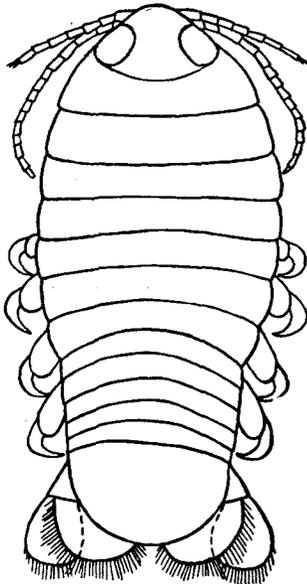


FIG. 3.—Young male of *Cymothoa recta*, × 12.

ONISCOIDEA.

Family LIGIIDÆ.

Ligia hawaiiensis Dana.

Ligia hawaiiensis, Dana, U. S. Expl. Exp., Crustacea, part 2, vol. XIV, pp. 740-741, pl. XLIX, fig. 4 a-c.

Locality: Pearl Harbor.

A single specimen, without uropods, is referred to the above species described by Dana from the islands Oahu and Kauai in the Hawaiian Archipelago. The specimen differs from the description in having shorter antennæ, which do not extend beyond the fifth thoracic segment. Difference in sex may account for this, as it has been shown that in this genus the antennæ of the females are shorter than those of the males.

Family ONISCIDÆ.

Porcellio lævis Latreille.

Porcellio lævis Latreille, Hist. Crust. Ins., VII, p. 46. Leach, Edinb. Encycl., VII, p. 406. Milne-Edwards, Hist. Nat. des Crust., III, p. 169. Budde-Lund, Nat. Tidsskrift, (3) VII, p. 236; Crust. Isop. Terrestria, 1886, pp. 138-141. (See Budde-Lund for further synonymy.)

Locality: Aiea, Oahu.

^a Naturhistorisk Tidsskrift, (3), XIV, 1883-84, pp. 276-278 and 281-282, pl. VIII, fig. 10-13, pl. IX, fig. 11.

EPICARIDEA or BOPYROIDEA.

Family DAJIDÆ.

ZONOPHRYXUS Richardson, gen. nov.

Type, *Zonophryxus retrodens* Richardson, sp. nov.

Body of female provided on the ventral side with a border which surrounds it on all sides, and which is wider in the anterior or cephalic region. The posterior portion of this marginal border is provided with nine small triangular processes, four on either side of the median one, and undoubtedly indicates five coalesced abdominal segments. Five pairs of legs are present on the anterior half of the ventral side. Five pairs of incubatory lamellæ on either side of the ventral surface meet in the median line, the fifth pair being narrow and elongate and concealing the second and third pairs, which are very small, and a part of the fourth pair. Dorsal surface convex, with only faint traces of segmentation, the boundaries of the three divisions of the body not being indicated. Small incisions at the side of

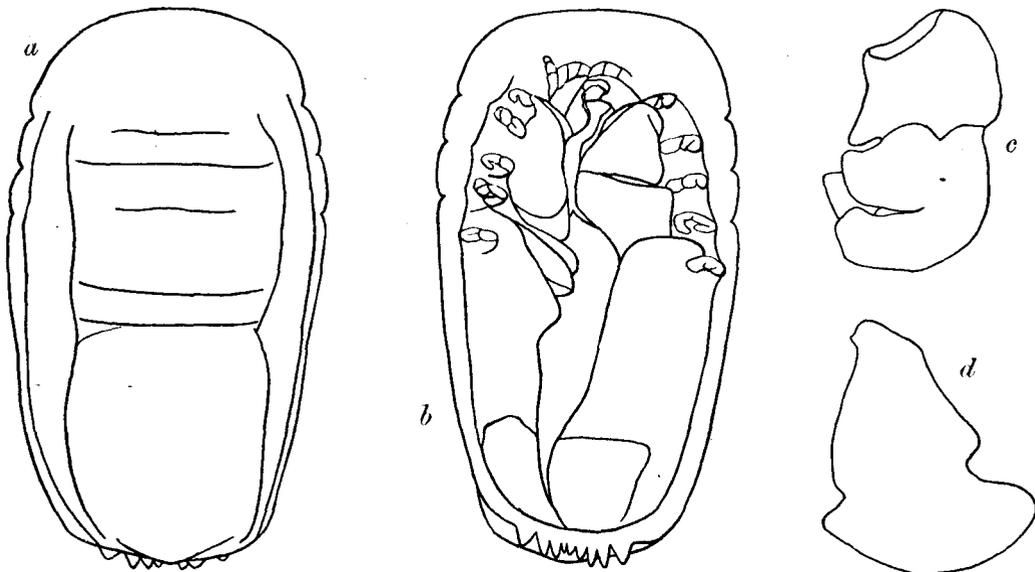


FIG. 4.—*Zonophryxus retrodens*. (a) Dorsal view, $\times 6.6$; (b) Ventral view, $\times 6.6$; (c) Maxilliped, $\times 9.33$; (d) First lamella of marsupium (right side), $\times 9.33$.

the anterior half of the body on the marginal border probably indicate the place of separation of the head from the thorax, the first thoracic segment from the second, and the second from the third.

Male with the first thoracic segment fused with the head. All 7 pairs of legs present. Segments of abdomen consolidated into one.

This genus differs from all the other *Dajidæ* in having a marginal border surrounding the body and in having nine triangular processes on the posterior margin of this border, representing 5 coalesced abdominal segments.

It differs from *Dajus* Kroyer in having the segments of the abdomen fused in the female; in having but slight traces of segmentation in the thoracic region, and in both male and female lacking uropoda. It differs from *Branchiophryxus* Caullery in having 5 pairs of legs and 5 pairs of incubatory lamellæ, only 4 pairs of legs and of incubatory lamellæ being true of *Branchiophryxus*, and in having a single pair of pleopoda, which are altogether wanting in that genus. It differs from *Notophryxus* Sars in the form of the abdomen and head, and in having 5 pairs of incubatory lamellæ instead of a single pair. It differs from *Aspidophryxus* Sars in the form of the head and abdomen of the female, and in having no trace of segmentation or appendages to the abdomen of the male.

Zonophryxus retrodens Richardson, sp. nov.

Body of female (fig. 4 *a, b*) rather quadrangular in shape, with only faint traces of segmentation on the dorsal surface. Dorsal surface very convex, with no distinct boundary between the three chief divisions of the body, the head, thorax, and abdomen being continuously one. On the ventral side a border surrounds the entire body, and is wider in the cephalic region.

The cephalic part projects in front as a broadly rounded area or border. On either side of the body on the anterior half, the lateral border is incised with three small indentations, marking off the head from the first thoracic segment, the second from the first, and the third from the second. Five indistinct lines on the dorsal surface of the anterior half of the body mark off the head from the thorax and outline the first four thoracic segments. The posterior half of the body shows no trace of segmentation on the dorsal surface. The posterior margin of the border at the terminal part of the body is produced in 9 triangularly-shaped processes. These processes are arranged four on either side of a median one, and undoubtedly indicate the 5 coalesced abdominal segments.

The legs are in 5 pairs and are confined to the anterior half of the body on the ventral side.

The incubatory lamellæ (fig. 4 *d*) consist of 5 pairs of plates, meeting in the median ventral line. The fifth pair overlap the second, third, and fourth pairs.

Only a single pair of pleopoda are present, which fold back upon the lower portion of the fifth pair of incubatory plates.

From the oral area there extends on the ventral side a long process, which subdivides and terminates in two lobes, one on either side, beneath the incubatory lamellæ.

The male (fig. 5) has the head fused with the first thoracic segment. The other 6 segments are free and distinct. All the segments of the abdomen are consolidated into one, which is somewhat oval and pointed posteriorly. All 7 pairs of legs are present, the first pair being attached to the cephalic segment. Head large, concave on its dorsal surface, the anterior margin produced into a rounded process, which is directed upward. Eyes wanting. No pleopoda or uropoda.

Only one specimen was obtained by the U. S. Fish Commission steamer *Albatross* from the south coast of Oahu Island, Hawaiian Islands, in 1902. The specimen was unattached.

Type in U. S. National Museum. Cat. No. 28970.

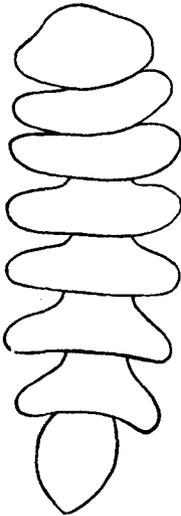


FIG. 5.—*Zonophryxus retrodens*. Male, × 13.3.

Family BOPYRIDÆ.

Subfamily ENTOPHILINÆ.

ENTOPHILUS Richardson, gen. nov.

Type, *Entophilus omnitectus* Richardson, sp. nov.

Body of female rather asymmetrical. Dorsal surface with segmentation indicated by depressions more or less clearly defined. All 7 pairs of legs present. Marsupium bounded ventrally by 5 pairs of incubatory lamellæ. Seven pairs of plates, overlapping the dorsal surface and attached only to the bases of the legs, extend in two longitudinal series, one on either side of the thorax; these plates probably correspond to the epimeral plates.

Two series of 5 plates each are present on either side of the abdomen, meeting along the median dorsal side and surrounding the abdomen at the sides, the lower plates nearly meeting again on the ventral side in the median line. Terminal part of abdomen truncate.

Pleopoda consisting of 5 pairs of double-branched lamellæ. Uropoda absent.

Male with the 6 segments of the abdomen clearly and distinctly defined, the last segment provided with a pair of single-branched uropoda; all the preceding segments of the abdomen provided with a pair of single-branched, well-developed pleopoda. Seven pairs of thoracic legs attached to the 7 thoracic segments.

Entophilus omnitectus Richardson, sp. nov. Fig. 6.

Body of female somewhat asymmetrical. Segmentation on dorsal surface more or less indistinctly defined. Marsupial pouch on ventral side extremely large and completely enclosed by incubatory lamellæ, which are visible from a dorsal view at the sides of the body.

Color of dorsal surface of thorax, orange; head, abdomen, and incubatory plates, white. The orange markings on the young within the marsupium give an orange appearance to the ventral side of the body.

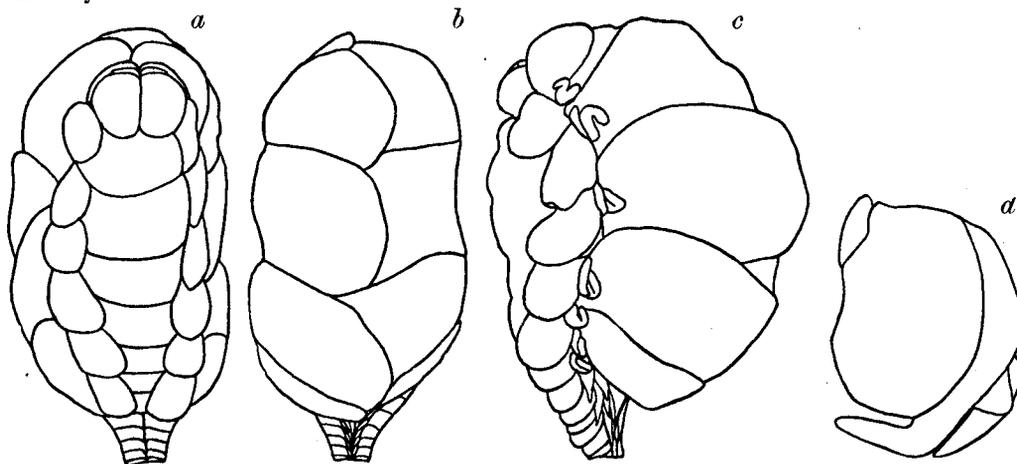


FIG. 6.—*Entophilus omnitectus*. (a) Dorsal view, $\times 6$; (b) Ventral view, $\times 6$; (c) Lateral view, $\times 6$; (d) Maxilliped, $\times 9.3$.

Head distinctly bilobed. Eyes absent. Both pairs of antennæ visible from a dorsal view, the first pair consisting of perhaps three indistinct joints. The second pair extend half the length of the head and consist of a number of indistinctly defined joints.

The segments of the thorax are more distinctly defined in some specimens than in others. Along the lateral margins of the thorax is a series of plates, a pair for each segment. These plates overlap

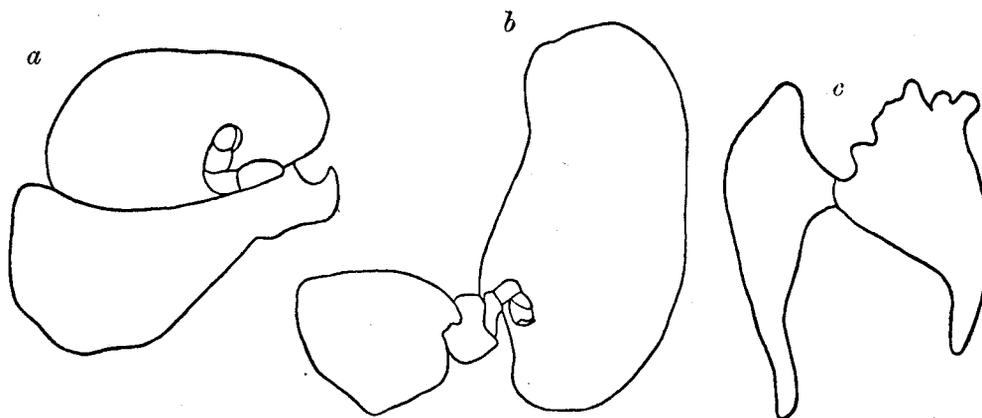


FIG. 7.—*Entophilus omnitectus*. (a) First lamella of marsupium, $\times 9.3$; (b) Leg of 5th pair with 5th lamella of marsupium attached (on right side) and 5th "lame pleurale," $\times 7$; (c) One double-branched pleopod, $\times 26$.

the dorsal surface of the thorax at the sides and are free on their whole surface, being attached only at the extreme lateral margin to the legs.

Similar plates are also found on the abdomen, where they meet five from either side along the median dorsal line. The exact homology of these plates is rather doubtful, but it seems probable that they correspond to the "lames pleurales" of Giard and Bonnier.

The 5 pairs of abdominal plates, which meet in the median line on the dorsal side, extend around the sides of the abdomen and gradually almost come together on the ventral side, the last pair being very much closer together than the first pair. The last two pairs of plates are almost concealed by the overlapping plates of the preceding segments.

The extremity of the abdomen is truncate and without uropoda. The pleopoda (fig. 7 c) are 5 pairs of double-branched tapering appendages, all similar in shape.

There are 5 pairs of incubatory lamellæ, which form the ventral side of the marsupial pouch, enclosing it completely, the lamellæ overlapping in the median line.

Seven pairs of small, feeble legs are present, a pair or each segment of the thorax.

The male (fig. 8) is narrow and elongate and without any color markings. The head is very large and without eyes. The 7 segments of the thorax are about equal in length, each one carrying a pair of appendages, so that there are 7 pairs of thoracic legs in all. The 6 segments of the abdomen are distinct, the terminal one being rounded and carrying a pair of single-branched appendages, the uropoda; the 5 preceding abdominal segments are provided each with a pair of single-branched, well-developed pleopoda.

A large number of specimens were obtained by the U. S. Fish Commission steamer *Albatross* on the north and northeast coast of Main Island, Hawaiian Islands, and the northeast approach to Pailolo Channel, between Main Island and Molokai Island.

The parasites were found in the visceral cavity of *Munnida normani* Henderson. This is the first

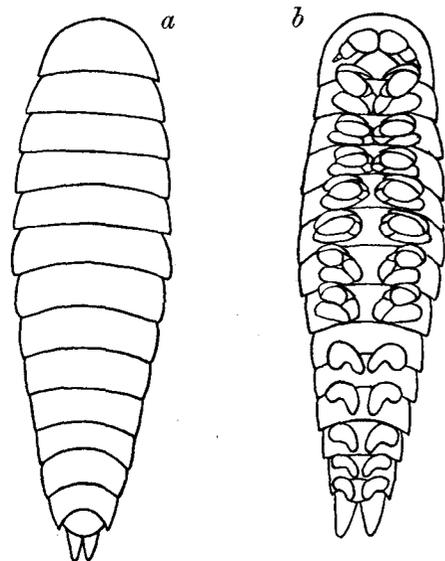


FIG. 8.—*Entophilus omnilectus*. Male. (a) Dorsal view, $\times 11.3$; (b) Ventral view, $\times 11.3$.

instance of the discovery of a Bopyrid in that position in relation to its host, all the other known representatives of the family being either branchial or abdominal parasites. The *Entoniscidae*, on the other hand, are always found in the visceral cavity.

Type in the U. S. National Museum. Cat. No. 28967.

LIST OF REFERENCES.

- BUDDE-LUND, G. *Crustacea Isopoda Terrestria*, 1885, pp. 138-141. Hauniae.
- CAULLERY, MAURICE. "*Branchiophryxus*, a new Epicarid parasite." *Zool. Anzeiger*, XX, pp. 88-92, 1897, 2 figs. Leipzig.
- DANA, JAMES G. U. S. Expl. Exp., *Crustacea*, XIV, 1853, pp. 740-741, pl. XLIX, fig. 4a-c. Philadelphia.
- EDWARDS, H. MILNE. *Hist. Nat. des Crust.*, III, p. 169, 1840. Paris.
- EDWARDS, MILNE. *Hist. Nat. Crust.*, III, 1840, p. 243. Paris.
- GIARD, ALFRED, and BONNIER, JULES. "Sur la Morphologie et la position systématique des Epicarides de la Famille des Dajidae." *Bull. Scien. France et Belgique*, 1889, XX, pp. 252-292, 9 figs. in text and pls. VI-VIII. Paris.
- LATREILLE, P. A. *Histoire Naturelle des Crustacés et des Insectes*, VII, 1804. Paris.
- LEACH, W. E. "Crustaceology." *The Edinburgh Encyclopedia*, VII, 1814. Edinburgh.
- SARS, G. O. *An Account of the Crustacea of Norway*, II, 1899, pp. 221-231, pls. xciii, xciv, xcvi, xcvi. Bergen.
- . "The Schizopoda collected by H. M. S. Challenger." *Challenger Report, Zool.*, 1885, XIII, Pt. XXXVII, pp. 220-221, pl. xxxviii, figs. 8-14. London.
- SCHIEDTE, J. C., and MEINERT, FR. "Symbolæ ad Monographiam Cymothoarum, Crustaceorum Isopodum Familiæ." *Naturhistorisk Tidsskrift* (3), XII, 1879-80, pp. 360-361, pl. VIII, figs. 7-9. Kjøbenhavn.
- SCHIEDTE, J. C. "Symbolæ ad Monographiam Cymothoarum, Crustaceorum Isopodum Familiæ, IV. Cymothoidæ. Trib. II. Cymothoinæ. Trib. III. Livonecinæ." *Naturhistorisk Tidsskrift* (3), XIV, 1883-84, pp. 276-278 and 281-282, pl. VIII, figs. 10-13, pl. IX, fig. 11. Kjøbenhavn.
- STEBBING, T. R. R. *History of Crustacea*, 1893, pp. 398-400, 408-419. New York.